

Transmittal Letter to the United States  
 Designated/Elected Office (DO/EO/US)

Prepared from  
 FORM PTO-1390

Attorney's Docket No. : M38-022  
 U.S. Application No. : Not yet assigned  
 International Application No. : PCT/IB00/00162  
 International Filing Date. : 16 February 2000 (16.02.00)  
 Priority Date Claimed : 16 February 1999 (16.02.99)  
 Title of Invention : Self-Adjusting Rotating Joint, Especially for Liquid  
 Distribution Devices  
 Applicant(s) for (DO/EO/US) : Arno DRECHSEL

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US)  
 the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☐ This express request to begin national examination procedures [35 U.S.C. 371 (f)] at any time rather than delay examination until the expiration of the applicable time limit set forth in 35 U.S.C 371(b) and PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed [35 U.S.C. 371(c)(2)]
  - a) ☒ is transmitted herewith (required only if not transmitted by the International Bureau)
  - b) ☐ has been transmitted by the international Bureau
  - c) ☐ is not required, as the application was filed in the United States Receiving Office (RO/US)
6. ☐ A translation of the International Application into English [35 U.S.C.371(c)(2)]
7. ☐ Amendments to the claims of the International Application under PCT Article 19 [35 U.S.C.371(c)(3)]
  - a) ☐ are transmitted herewith (required only if not transmitted by the International Bureau)
  - b) ☐ have been transmitted by the International Bureau
  - c) ☐ have not been made; however, the time limit for making such amendments has **NOT** expired.
  - d) ☐ have not been made and will not be made
8. ☐ A translation of the amendments to the claims under PCT Article 19 [35 U.S.C.371(c)(3)]
9. ☒ An oath or declaration of the inventor(s) [35 U.S.C.371(c)(4)]
10. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 [35 U.S.C.371(c)(5)]

Items 11. to 16. below concern other document(s) or information included:

11. ☒ An Information Disclosure Statement under 37 C.F.R. 1.97 and 1.98
12. ☐ An Assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included
13. ☒ A **FIRST** preliminary amendment
14. ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment
15. ☐ A substitute specification
16. ☐ A change of power of attorney and/or address letter
16. ☒ (other items or information) U.S National Phase Application; PCT Publication WO 00/48741; Form PCT/IPEA/408; Form PCT/ISA/220; Form PCT/IPEA/416; Form PCT/IPEA/409; Form PCT/IB/332; and 7 cited references (DE 577 183; CH 323 524; US 4,231,522, EP 0 630 689, DE 561 670, CH 181 969, and US 3,744,720).

EXPRESS MAIL No.: EL 890 537 715 US Deposited: August 15, 2001

I hereby certify that this correspondence is being deposited with the United States Postal Service Express mail under 37 CFR 1.10 on the date indicated above and is addressed to the Commissioner of Patents and Trademarks, Washington, DC 20231.

Helen Tam

August 15, 2001  
 Date

17. ☒ The following fees are submitted:

|   |   | CALCUL-<br>ATIONS | PTO USE<br>ONLY  |
|---|---|-------------------|------------------|
| <b>BASIC NATIONAL FEE [37 CFR 1.492(a)(1)-(5)]:</b>   |   |                   |                  |
| <input checked="" type="checkbox"/>   | Search Report has been prepared by the EPO or JPO   | \$ 860.00         | \$ 860.00        |
| <input type="checkbox"/>  | International preliminary examination fee paid to USPTO [37 CFR 1.482]  | \$ 690.00         |                  |
| <input type="checkbox"/>  | No International preliminary examination fee paid to USPTO [37 CFR 1.482] but International search fee paid to USPTO [37 CFR 1.445(a)(2)] | \$ 710.00         |                  |
| <input type="checkbox"/>  | Neither International preliminary examination fee [37 CFR 1.482] nor International search fee [37 CFR 1.445(a)(2)] paid to USPTO          | \$ 1000.00        |                  |
| <input type="checkbox"/>  | International preliminary examination fee paid to USPTO [37 CFR 1.482] and all claims satisfied provisions of PCT Article 33(1)-(4)       | \$ 100.00         |                  |
| <b>ENTER APPROPRIATE BASIC FEE AMOUNT</b>   |   | \$ 860.00         |                  |
| Surcharge of \$130.00 for furnishing the oath or declaration later than <u>20</u> <u>30</u> months from the earliest claimed priority date [37 CFR 1.492(e)]      |   |                   |                  |
| Claims  | Number filed  | Number extra      | Rate             |
| Total Claims  | 13 -20=   | 0 x               | \$ 18. = \$ 0.00 |
| Indep. Claims   | 1 - 3=  | 0 x               | \$ 80. = \$ 0.00 |
| Multiple Dependent Claim(s) (if applicable) + \$ 260. = \$  |   |                   |                  |
| <b>TOTAL OF ABOVE CALCULATIONS = \$ 860.00</b>  |   |                   |                  |
| Reduction by 1/2 for filing by small entity, if applicable.   |   |                   |                  |
| Verified Small Entity Statement must be filed.  |   |                   |                  |
| [Note 37 CFR 1.9, 1.27, 1.28]   |   |                   |                  |
| <b>SUBTOTAL = \$ 430.00</b>   |   |                   |                  |
| Processing fee of \$130.00 for furnishing the English Translation later than <u>20</u> <u>30</u> months from the earliest claimed priority date [37 CFR 1.492(f)] |   |                   |                  |
| <b>TOTAL NATIONAL FEE = \$ 430.00</b>   |   |                   |                  |
| Fee for recording the enclosed assignment [37 CFR 1.21(h)]  |   |                   |                  |
| The assignment must be accompanied by an appropriate cover sheet [37 CFR 3.28, 3.31]. \$40.00 per property  |   |                   |                  |
| <b>TOTAL FEES ENCLOSED = \$ 430.00</b>  |   |                   |                  |
| (AMOUNTS TO BE  |   | REFUNDED \$       |                  |
| REFUNDED OR CHARGED)  |   | CHARGED \$        |                  |

a) ☒ A check in the amount of **\$430.00** to cover the above fees is enclosed.

b) ☐ Please charge my Deposit Account No. **04-0838** in the amount of \$ to cover the above fees. A duplicate copy of this sheet is enclosed.

c) ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. **04-0838**. A duplicate copy of this sheet is enclosed.

**NOTE:** Where an appropriate time limit under 36 CFR 1.494 or 1.495 has not been met, a petition to revive [37 CFR 1.137(a) or (b)] must be filed and granted to restore the application to pending status.

**SEND ALL CORRESPONDENCE TO:**

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31,669  
Reg. No.

August 15, 2001  
Date

516 Rec'd PCT/PTO 15 AUG 2001

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT(S) : Arno Drechsel  
SERIAL NO. : Not Yet Assigned  
FILED : Herewith  
PCT APPLN. NO. : PCT/IB00/00162  
INT'L FILING DATE: 16 February 2000  
FOR : Self-Adjusting Rotating Joint, Especially for Liquid  
Distribution Devices

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Commissioner for Patents  
Washington, D.C. 20231

PRELIMINARY AMENDMENT

S I R:

Prior to examination of the above-identified application, applicant requests that the application be amended as follows:

## IN THE CLAIMS:

Cancel claims 1-13 and add the following new claims:

14. A self-adjusting rotating joint, particularly for liquid distribution devices,  
comprising:  
a substantially tubular stationary lower element adapted to be connected to a  
liquid feeding inlet pipe;  
a substantially tubular rotatable upper element adapted to be connected to a  
liquid distribution nozzle;  
connecting means adapted to pivotally connect said upper rotatable element

and said lower stationary element so as to allow their relative rotation about a common axis with limited axial relative displacement, thereby transferring a reaction force produced by the jet in a plane passing through said common axis;

braking means to counter the relative rotation of said upper and said lower elements about said rotation axis;

said connecting means comprising a substantially cylindrical tubular connecting element with substantially constant outer diameter;

said tubular connecting element being a section of predetermined length cut from an indefinite pipe having a substantially cylindrical outer surface with no annular flange, said section of pipe being rigidly secured to one of said upper and lower element with at least part of said substantially cylindrical outer surface, said braking means being separate from said tubular connecting element, a sleeve of substantially cylindrical shape being rigidly attached to one of said upper and lower elements for interacting with said braking means to controllably counter the rotation of said upper rotatable element.

15. The self-adjusting rotating joint according to claim 14 wherein said tubular connecting element is rotatably coupled to the other of said upper and lower elements with the interposition of at least one antifriction annular member.

16. The self-adjusting rotating joint according to claim 14 wherein said tubular connecting element is fixedly attached to said upper rotatable element.

17. The self-adjusting rotating joint according to claim 16 wherein said sleeve

has a flange interacting with said braking means to controllably counter the rotation of said upper rotatable element.

18. The self-adjusting rotating joint according to claim 17 wherein said braking means comprise pads of material with high wear resistance, adapted to interact with substantially annular braking surfaces unitarily joined to said flange.

19. The self-adjusting rotating joint according to claim 16 wherein said sleeve is rigidly secured to an end portion of said lower stationary element and is placed peripherally of said tubular connecting element.

20. The self-adjusting rotating joint according to claim 19 wherein said sleeve has a substantial cylindrical central portion connected to axial end portions adapted to house substantially annular braking pads.

21. The self-adjusting rotating joint according to claim 20 wherein said annular braking pads have internal cylindrical surfaces in friction contact with said tubular connecting element to transfer the reaction to the force exerted by the jet in an axial plane passing through said common axis, and planar annular surfaces acting on braking surfaces connected to said upper rotatable element to controllably counter its rotation with respect to said lower stationary element.

22. The self-adjusting rotating joint according to claim 14 wherein said tubular connecting element is unitarily fixed to said lower stationary element.

23. The self-adjusting rotating joint according to claim 22 wherein annular members are rigidly fixed to said upper rotatable element, said annular members being axially spaced and being interposed between said tubular connection element and said upper rotatable element to define a friction pad and to transmit to said lower stationary element forces acting on said upper rotatable element

24. The self-adjusting rotating joint according to claim 22 wherein said sleeve is rigidly coupled to said upper rotatable element and is provided with a flange interacting with said braking means.


25. The self-adjusting rotating joint according to claim 24 wherein said braking means consist of pads unitarily secured to said flange on opposite sides thereof and adapted to interact with braking surfaces defined by substantially annular elements of high wear resistance material.

26. The self-adjusting rotating joint according to claim 18 wherein said pads are shaped as continuous rings or circular sectors circumferentially spaced and placed peripherally of said sleeve, elastic means being provided to force said pads against said braking surfaces.

**REMARKS**

Claims 14-26 are pending in the application, claims 1-13 being canceled and claims 14-26 being newly added herein. Claim 14 is the only independent claim.

Respectfully submitted,  
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SELF-ADJUSTING ROTATING JOINT, ESPECIALLY FOR LIQUID  
DISTRIBUTION DEVICES

Technical Field

5

The present invention relates to a self-adjusting rotating joint, particularly for distribution devices of liquids under pressure, of the pulse sprinkler or similar type, with all the features mentioned in the preamble of the main claim.

- 10 The rotating irrigators of the above mentioned type, with continuous or discontinuous operation, can be used in agriculture, for example to irrigate crops or surfaces of various dimensions, or in industry, for dust cloud laying or to humidify, cool down or treat material extracted from mines. Depending on the use, liquids distributed can be of various types, for example pure water,  
15 sea water, saline or acid solutions.

- Such irrigators may have large dimensions and may be mounted on mobile or fixed irrigation systems. The pressurised liquid is distributed through a nozzle which is connected to the feeding duct of the liquid by means of a rotating  
20 joint. Such joint comprises bearings allowing the nozzle to pivot on a full circumference about the axis of the joint, or for a circular sector if the plant or irrigation system so requires, to have the most uniform distribution of the liquid or to avoid spraying of buildings, roads, persons or other kind of obstacles.

25

- On the body of the nozzle, means are provided to crush the jet and to move the nozzle with continuous or stepwise rotation. Because of the strong forces generated by the jet reaction, such joints must be able to transfer high torque. Moreover, to prevent an uncontrolled rotation of the nozzle, the joint is  
30 provided with appropriate brake means to resist the moment causing nozzle

518 Rec'd PCT/PTO 15 AUG 2001

rotation. Such means exert their braking action at various pressure levels of the liquid flowing in the duct. In this manner the effect of the irrigation is improved, and a more uniform and diffused distribution of the liquid on the surface to be sprinkled or on the cultivation to be irrigated is achieved.

5

### Background art

There are known irrigators of the type described above which can support high pressures and are provided with braking means to ensure a sprinkler rotation as constant and controlled as possible.

10

US-A-4231522 discloses a stepwise rotating sprinkler provided with a jet deflection system which transmits also the necessary torque to produce jet rotation. In this sprinkler there are also provided braking means ensuring nozzle rotation at substantially constant angular velocity both when the pressure of the irrigation water is rather elevated, that is at full capacity operation, and when the pressure is comparatively low, for example during the system starting phase, when the liquid feeding pump has not reached the steady state or operates at a reduced pressure for other reasons.

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In such sprinkler it is necessary to provide for a structural element which has the function of transferring the high forces produced by the jet. This element joins the two parts of the rotating joint moving with relative motion and has both the function of transmitting the torque generated by jet reaction and that of being an interaction surface for the braking elements.

25

A first disadvantage of this known sprinkler is that the structural element connecting the two parts of the rotating joint is rather difficult to make because it must be submitted to a rather high number of machining operations starting from a single piece, which is <sup>2</sup>rather difficult and costly ~~an~~ operation.

30

Moreover the complex shape of this piece is such as to cause an excessive scrap of material during the manufacture. In addition, since such element must be water tight in the contact zone with the packing and the bearing placed around it, it must have an accurate surface finish. Generally such pieces  
5 require very fine and accurate working of the surface with a machine tool and subsequently their surface must be hardened or chrome-plated to guarantee maximum resistance against oxidation and abrasive action of the liquid.

In the sealing zone between bearing and tubular element, it is necessary to  
10 provide for as small as possible a clearance between the moving parts to guarantee a perfect water tightness of the lip seal, as liquid leakage can produce in the long run oxidation, or even corrosion in other elements of the joint hampering correct operation thereof. The liquid to be sprayed generally contains many impurities that can sometimes seep in the contact zones  
15 between the two elements which rotate relatively to each other and can damage the surface of the bearing and that of the chrome-plated metal element.

It has also been proposed to use sprinklers with rotating joints characterised  
20 by high mechanical resistance to counter the torque acting on the joint itself when the sprinkler is in operation. A solution of this kind is described in EP-B-630689 disclosing a rotating joint for sprinkler, provided with braking means and with high flexural resistance to bending caused by jet reaction. However such joint presents a remarkable complexity, as the various parts  
25 from which it is formed have complex shapes and are thus expensive to manufacture.

### Summary of the invention

30 It is an object of the present invention to overcome the above mentioned

drawbacks by providing a selfadjusting rotating joint for liquid distribution, in particular for irrigation, which has a simplified structure, is easy to produce, has high effectiveness and low cost.

- 5 Another object of the invention is to provide a selfadjusting rotating joint with a high flexural stiffness against the jet reaction force.

It is a further object of the invention to provide a lighter joint compared to known sprinkler joints.

10

Another object of the invention is to provide a rotating joint with no need for maintenance during long periods.

15

Another object of the present invention is to provide a rotating joint having a simplified structure such as to allow easy assembling and disassembling for spare part substitution and providing high reliability.

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These objects and other that will become apparent hereinafter are achieved by a rotating joint as defined above, <sup>in the attached claim 1,</sup> ~~characterised in that said connection means consist of a substantially cylindrical tubular element with a substantially constant outer diameter.~~

#### Brief description of the drawings

- 25 Further characteristics and advantages of the invention will become apparent from the detailed description of some preferred, but non exclusive, embodiments of the rotating joint according to the invention, illustrated by way of a non limitative example by means of the enclosed drawings where:

30 Fig. 1 shows a partially sectioned perspective view of the rotating joint according to the invention;

Fig. 2 shows a longitudinal sectional view taken along an axial plane of the joint of Fig. 1;

Fig. 3 shows a longitudinal sectional view taken along an axial plane of a modified embodiment of the joint of the Fig. 1 and 2;

5 Fig. 4 shows an overall perspective and partially sectioned view of a second embodiment of the rotating joint according to the invention.

Fig. 5 shows a longitudinal sectional view taken along an axial plane of the joint of Fig. 4;

10 Fig. 6 shows a longitudinal sectional view taken along an axial plane of an embodiment of the joint of Fig.4;

Fig. 7 shows a longitudinal sectional view taken along an axial plane of a further embodiment of the rotating joint according to the invention;

Fig. 8 shows a longitudinal section along an axial plane of a further modified embodiment of the joint according to the invention;

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Detailed description of some preferred embodiments

With reference to the cited Figures 1 and 2, the rotating joint, generally indicated with reference numeral 1, is essentially made of two main elements  
20 referenced respectively 2 and 3. A lower element 3 has a substantially tubular shape and is connected to an irrigation liquid feeding duct, not shown in the drawings, by means of a threaded fastener, a flange or other equivalent connecting means. A lower element ~~3~~<sup>5</sup> can be fixed to the ground, to a rigid column or to a self-moving structure.

25 The upper portion of the lower element 3 is connected to the upper element 2, which is likewise of substantially tubular shape. These elements are mutually ~~joined~~<sup>joined</sup> with suitable connection means, so as to allow relative rotation of the upper element 2 with respect to the lower fixed element 3 around a  
30 substantially vertical axis V, common to both elements.

The upper element 2 is connected to an elbow joint 4, to which a nozzle producing the jet, not shown in the drawings, is generally connected. In turn, suitable means for drawing kinetic energy, of known type, may be provided to impart to the nozzle, and consequently to its upper element 2, a cyclic rotation, about the axis V, over a complete turn or only by a circular sector.

The two elements 2 and 3 forming the body of the joint are advantageously made of particularly light material, suitably selected to reduce the weight of the assembly and to produce the necessary resistance to forces generated during use by the pressurised liquid.

The upper element 2, which functions also as joint cover, is so shaped to reduce to a minimum infiltration from the outside of water splitting during irrigation or which is splashed backward by the nozzle propulsion system.

The upper element 2 is advantageously made of two portions 2' and 2'' reciprocally coupled by means of screws 5 so as to facilitate access to the joint 1 and to allow an easy maintenance, repair or substitution of the various components subject to wear.

According to the invention, the pivot connection means between the upper element 2 and the lower one 3 is constituted by a substantially cylindrical tubular element 6, having a substantially constant outer diameter and a longitudinal axis V.

Thus, the connecting tubular element 6 will allow rotation of the movable element 2 with respect to fixed element 3 about the common axis V, while allowing limited axial relative movement of these elements 2, 3, so as to allow the transmission of reaction forces generated by the jet and acting in a substantially vertical plane passing through the rotation axis V.

Advantageously, the connecting tubular element 6 may be obtained by cutting a piece of appropriate length from an indefinite pipe. Still more advantageously, such indefinite pipe can be chosen between those normally available on the market, with diameter of appropriate dimensions and with appropriate surface finishing adapted to ensure low coupling tolerance. Thus, it will be possible to reduce the production costs of this important component.

Preferably, the connecting element 6 can be made of metal, for example stainless steel, or other materials having the same mechanical strength, resistance to oxidation and corrosion, such as composite or ceramic materials.

In a first embodiment, the element 6 is rigidly attached to the upper element 2 of the joint 1. The attachment can be made by gluing, pressing, welding, immersion, threading or any other similar means, depending on the materials of which are made the pieces to be reciprocally coupled. To improve anchoring and ensure a stable coupling with element 2, the outer surface of the connection element 6 can be provided with surface discontinuities, such as e.g. grooves, annular and/or radial notches 7, or other similar shapes.

A bushing or bearing 8 in antifriction material, for example plastic material with low friction coefficient and high resistance to compression, is located between the body of the fixed element 3 and the connecting tubular element 6. The bushing or bearing 8 has narrow tolerances with respect to element 6 to allow free rotation thereof, though ensuring sufficient tightness between the two elements 2, 3.

In turn, the bearing 8 is fixedly secured to a sleeve 9 having a radially outwardly extending flange 10. The sleeve 9 is in turn anchored to the lower element 3 of the joint by means of a ring 11 fixed by screws or bolts 12.

A first lip gasket 13 is interposed between elements 2, 3 to avoid <sup>leakage</sup> ~~seepage~~ between the two elements, which would produce pressure losses with reduction of liquid distribution efficiency. Moreover, as the irrigation liquid is generally mixed with dirt, the infiltration of such dirt between the bearing 8 and the connecting element 6 in the long run causes scratches or notches both on the internal surface of the bearing 8 and on the outer surface of the element 6. This would involve a quicker consumption of the components, with an increase of costs and high seizure risk between the parts in relative movement, with consequent blocking of the rotating part.

In addition to the first gasket 13, a second gasket 14 may be provided to avoid infiltration of liquid, dust cloud, sand or other impurity in the interstices between bearing 8 and pipe 6, neither from the outside nor from the inside of the joint.

Two flat rings 15 and 16 made of material of greater hardness than that of the material of the sleeve 8, preferably stainless steel, are fixed on flange 10. One of the rings, in particular the ring 15 is fixed to the upper surface of the flange 10, the other ring 16 is fixed to the lower surface of the flange 10.

Rings 15 and 16 define contact surfaces for corresponding pads 17 and 18 and constitute with the latter braking means for adjusting the rotation speed of the irrigation nozzle. Pads 17 and 18 operate like normal disk brakes both when the liquid pressure is high and when the pressure is low.

As mentioned above, the upper element 2 can axially shift by a limited distance with respect to the lower element 3, so as to force upward the pad 18 when the water is pressurised, and to act by gravity on the pad 17 when the liquid pressure in the irrigation duct drops to a minimal level.

Pads 17 and 18 are suitably made of high resistance plastic material and can extend along a whole circumference to form a unitary ring.

As an alternative, they can be shaped as separate annular segments. Pads 17 and 18 are constantly kept in contact with rings 15 and 16 by suitable elastic means, such as e.g. compression springs 19 or equivalent means.

In the alternative embodiment of the joint shown in the Fig. 3, the elements equivalent to those of figures 1 to 3 have been identified with the same reference numerals. In such alternative embodiment, the position of the contact rings 20 and 21 and pads 22 and 23 is inverted. In other words, the pads 22, 23 act against the opposite surfaces of the flange 10 and are urged against the same by springs placed in corresponding seats made in the flange, not shown in the figure.

The Fig. 4 shows another embodiment of the joint according to the invention, in which the connecting tubular element 25 is fixedly secured to the lower element 3 and remains stationary during rotation of the irrigation nozzle, while the upper element 2 rotates with respect to the elements 3 and 25 fixed to each other.

On the contrary, the sleeve 26 and the bearing or bushing 27 are jointly anchored to the upper element 2 and turn also with respect to the lower element 3.

Also in this second embodiment it is possible to provide two alternate arrangements of the braking means. In the first arrangement, illustrated in Fig. 5, the pads 22 and 23 are driven into rotation by the flange 10, while the respective metal contact discs 20 and 21 are joined to corresponding surfaces of the upper element 2. Such arrangement corresponds to that with the

braking means already shown and disclosed in Fig. 3.

The second arrangement of the braking means, schematically depicted in Fig. 6, corresponds to the arrangement with the braking pads equivalent to that already visible in Fig. 1 and 2, in which the pads 17, 18 are driven in rotation by the upper element 2 of the joint and act against the rings 15, 16 fixedly joined to the upper and lower surfaces of the flange 10.

In the embodiment of the joint according to the invention shown in Fig. 7, elements similar to those of the embodiments already described in the previous figures have been identified with the same reference numerals. In this embodiment, which has a structure similar to that of Fig. 1 and 2, the connecting tubular element ~~5~~<sup>25</sup> is jointly secured to the fixed lower element 3 by suitable securing means.

Two rings 28 and 29 having supporting function for the element 2 are placed around the upper rotating element 2. These rings act as friction bearings and for this reason are made of low friction material, for example plastic, with high structural resistance and low friction factor. Such bearings maintain the rotating element 2 in the right position with respect to the fixed element 3 and allow its rotation under the action of the torque produced by the jet of liquid flowing out from the nozzle.

Rings 28, 29 have a substantially L-shaped cross section, with shorter sides 28', 29' and longer sides 28'', 29''. The shorter sides 28', 29' are substantially planar and perpendicular to the rotation axis V and they act as guides for element 2. The longer sides 28'' and 29'' define cylindrical friction surfaces acting against the internal surface of the connecting tubular element 25. Also in this embodiment the gasket 13, for example of the lip type, ensures perfect water tightness of the joint.

It is observed that in all the embodiments described heretofore the flange 10 can be provided with lightening grooves of various shapes, and made of a lighter material than that of elements 6, 25. In fact in the embodiments of joint according to the invention, the forces acting on the sleeve are smaller than those acting on the connection element 6, 25, which must instead support strong bending moments.

Fig. 8 shows a further alternative embodiment of the joint according to the invention, in which the tubular connecting element 6 is unitarily secured to the upper element 2 of the joint and rotates together with the latter with respect to the fixed lower element 3.

A peculiarity of this latter embodiment is that the tubular connecting element 6 has a rather big length and low thickness as compared with the former embodiments.

An outer sleeve 30 is fixedly secured to the lower element 3 by means of screws 12. In the sleeve there can be recognised an essentially cylindrical central portion 30' connected to axial end portions 30'', 30''' with outer diameters larger than those of the central portion 30'.

Inside the end portions 30'', 30''', there are placed respective pads 31, 32, made of plastic material or similar, having axial protrusions 33, 34 engaging with corresponding seats 35, 36 made in the portions 30'', 30'''.

Pads 31 and 32 have substantially planar annular portions 31', 32' acting against the facing surfaces of rings 20 and 21 fixedly attached to the tubular element 6, so as to exert a braking action on rings 20, 21. Pads 31, 32 are axially forced against the rings 20, 21 by compression springs or equivalent

INV0751

elastic means, not shown in the figure and placed in the seats 35, 36.

Pads 31, 32 moreover have internal cylindrical surfaces 31", 32" acting on the external surface of the tubular element 6 to exert on it a reaction to the radial force F produced by the jet of liquid flowing from the nozzle of the irrigator. The distance between the two portions 30" and 30'" is suitably selected in such a manner that the above-mentioned reaction force F produces strong radial stresses that can be borne by a part of the rings 31 and 32. In this embodiment, the tubular connecting element 6 is provided with two connecting rings respectively referenced 37, 38 and axially mutually spaced. The connection rings 37, 38 are secured with any known means, respectively to the upper and lower end portions of the connecting element 6.

Particularly, the upper ring 37 is rigidly secured to the tubular element 6 in correspondence of the upper end portion by means of a metal ring 39 with conical cross section that is adapted to tighten a split ring 40, having a similar conical cross section but with inverted taper. Rings 37 and 38 define respective axial abutments for rings 20 and 21 which provide the braking surfaces.

Although the self-adjusting rotating joint according to the invention has been described with specific reference to the reference numerals indicated in the description and in the figures, it is obvious that such numerals are purely indicative and in no way limit the scope of invention as defined in the appended claims.

~~The contents of Italian patent application No. V199A000030, for which priority is claimed, are incorporated herein by reference.~~

INV0751

NEW CLAIMS

1. Self-adjusting rotating joint (1), particularly for liquid distribution devices, comprising:

- a substantially tubular stationary lower element (3), adapted to be connected to a liquid feeding inlet pipe,

- a substantially tubular rotatable upper element (2), adapted to be connected to a liquid distribution nozzle,

- connecting means (6, 25) adapted to pivotally connect said upper rotatable element (2) and said lower stationary element (3), so as to allow their relative rotation about a common axis (V), with limited axial relative displacement, thereby transferring a reaction force produced by the jet in a plane passing through said common axis (V);

- braking means (10, 15, 16, 17, 18, 20, 21, 22, 23, 30, 31) to counter the relative rotation of said upper and said lower elements (2, 3) about said rotation axis (V);

- said connecting means comprising a substantially cylindrical tubular connecting element (6, 25) with substantially constant outer diameter;

characterised in that said tubular connecting element (6, 25) is a section of predetermined length cut from an indefinite pipe having a substantially cylindrical outer surface with no annular flange, said tubular connecting member (6, 25) being rigidly secured to one of said upper and lower elements (2, 3) with at least part of its substantially cylindrical outer surface, said braking means (10, 15, 16, 17, 18, 20, 21, 22, 23, 30, 31) being separate and independent from said tubular connecting element (6, 25).

2. Self-adjusting rotating joint according to claim 1, characterised in that said tubular connecting element (6, 25) is rotatably coupled to the

INV0751

other of said upper and lower elements (2, 3) with the interposition of at least one antifriction annular member (8, 27),

3. Self-adjusting rotating joint according to claim 1, characterised in that said tubular connecting element (6) is fixedly attached to said upper rotatable element (2).

4. Self-adjusting rotating joint according to claim 3, characterised in that a sleeve (9) of substantially cylindrical shape is rigidly attached peripherally of said lower stationary element (3), said sleeve (9) having a flange (10) interacting with said braking means to controllably counter the rotation of said upper rotatable element (2).

5. Self-adjusting rotating joint according to claim 4, characterised in that said braking means comprise pads (17, 18) of material with high wear resistance, adapted to interact with substantially annular braking surfaces (15, 16) unitarily joined to said flange (10).

6. Self-adjusting rotating joint according to claim 3, characterised in that a sleeve (30) of substantially cylindrical shape is rigidly secured to an end portion of said lower stationary element (3) and placed peripherally of said tubular connecting element (6).

7. Self-adjusting rotating joint according to claim 6, characterised in that said sleeve (30) has a substantial cylindrical central portion (30') connected to axial end portions (30'', 30''') adapted to house substantially annular braking pads (30, 31).

INV0751

8. Rotating joint according to claim 7, characterised in that said annular braking pads (31, 32) have internal cylindrical surfaces (31", 32"), in friction contact with said tubular connecting element (6) to transfer the reaction to the force (F) exerted by the jet in an axial plane passing through said common axis (V), and planar annular surfaces (31', 32') acting on braking surfaces (20, 21) connected to said upper rotatable element (2) to controllably counter its rotation with respect to said lower stationary element (3).

9. Self-adjusting rotating joint according to claim 1, characterised in that said tubular connecting element (25) is unitarily fixed to said lower stationary element (3).

10. Self-adjusting rotating joint according to claim 9, characterised in that annular members (28, 29) are rigidly fixed to said upper rotatable element (2), said annular members (28, 29) being axially spaced and being interposed between said tubular connection element (25) and said upper rotatable element (2) to define a friction pad and to transmit to said lower stationary element (3) forces acting on said upper rotatable element (2).

11. Self-adjusting rotating joint according to claim 9, characterised in that a sleeve (26) of substantially cylindrical shape is rigidly coupled to said upper rotatable element (2) and is provided with a flange (10) interacting with said braking means (20, 21) to controllably counter the rotation of said rotatable upper element (2).

12. Self-adjusting rotating joint according to claim 9, characterised in that a sleeve (26) of substantially cylindrical shape is rigidly coupled to said upper rotatable element (2) and is provided with a flange (10), said braking

INV0751

means consisting of pads (22, 23) unitarily secured to said flange (10) on opposite sides thereof and adapted to interact with braking surfaces (20, 21) defined by substantially annular elements of high wear resistance material.

13. Self-adjusting rotating joint according to any of the claims 5, 7 or 12, characterised in that said pads (17, 18, 22, 23, 31, 32) are shaped as continuous rings or circular sectors circumferentially spaced and placed peripherally of said sleeve (8, 26, 30), elastic means (19, 24) being provided to force said pads (17, 18, 22, 23, 31, 32) against said braking surfaces.

1/8

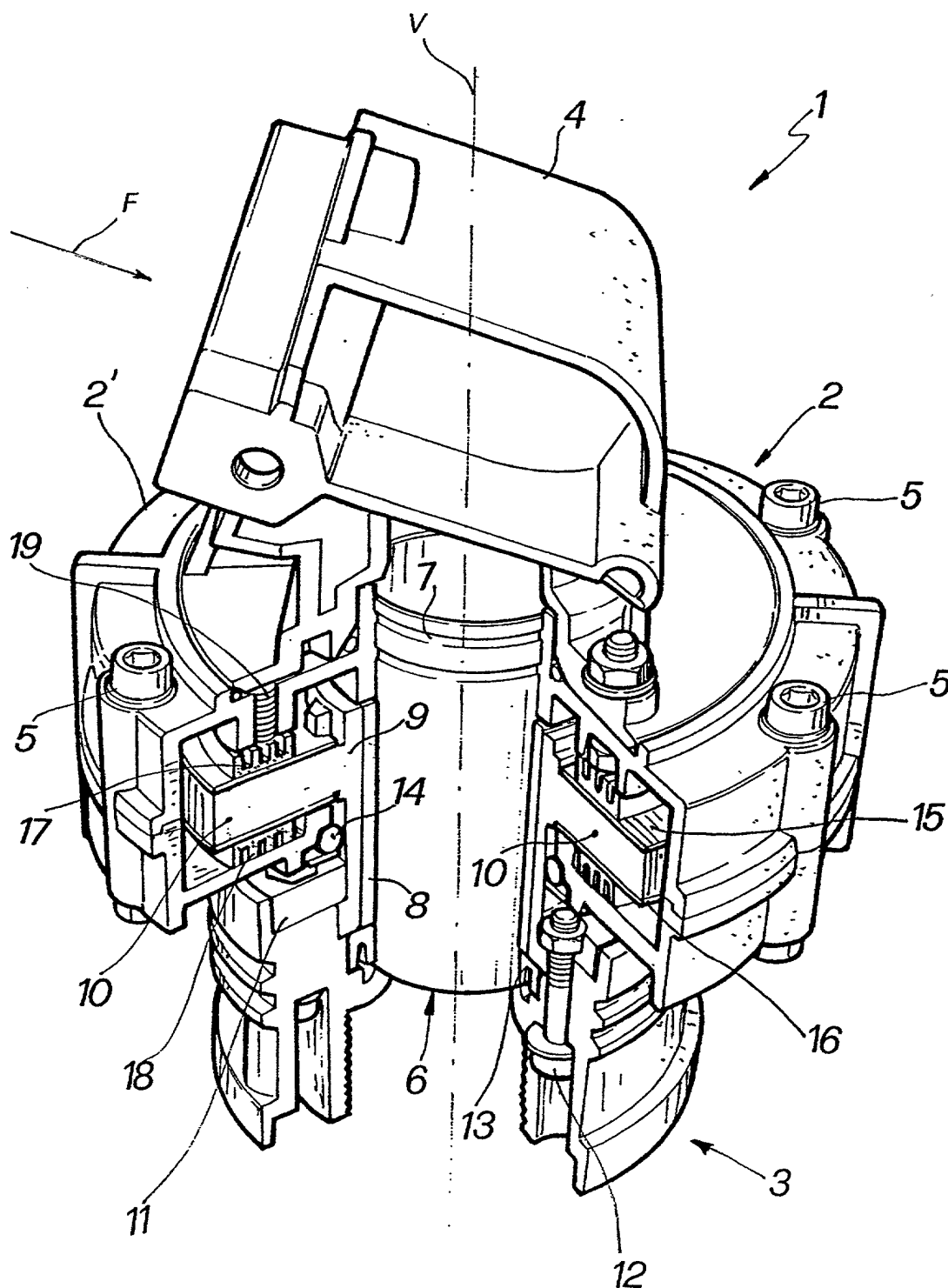


Fig. 1

2/8

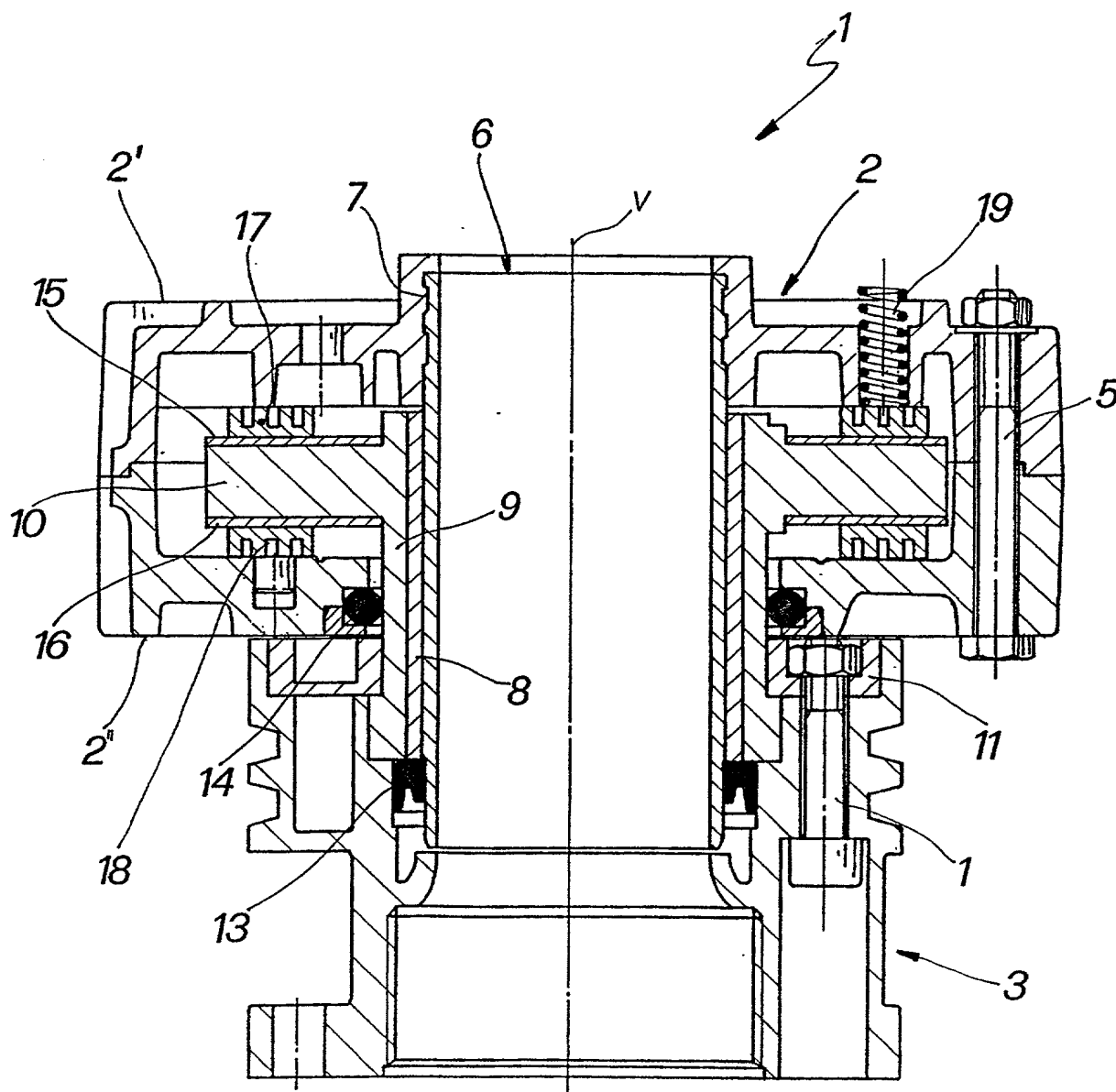


Fig. 2

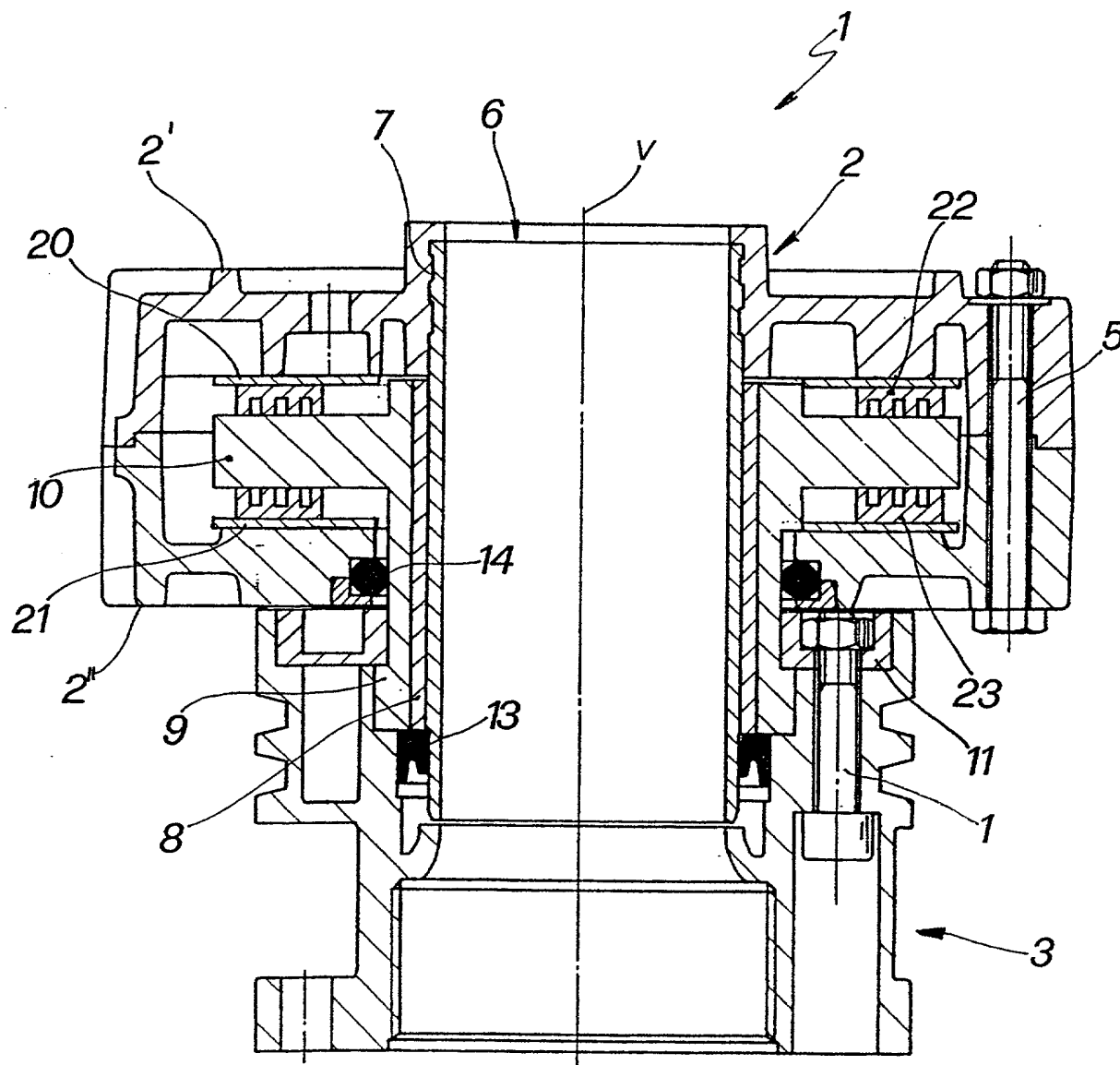


Fig. 3

4/8

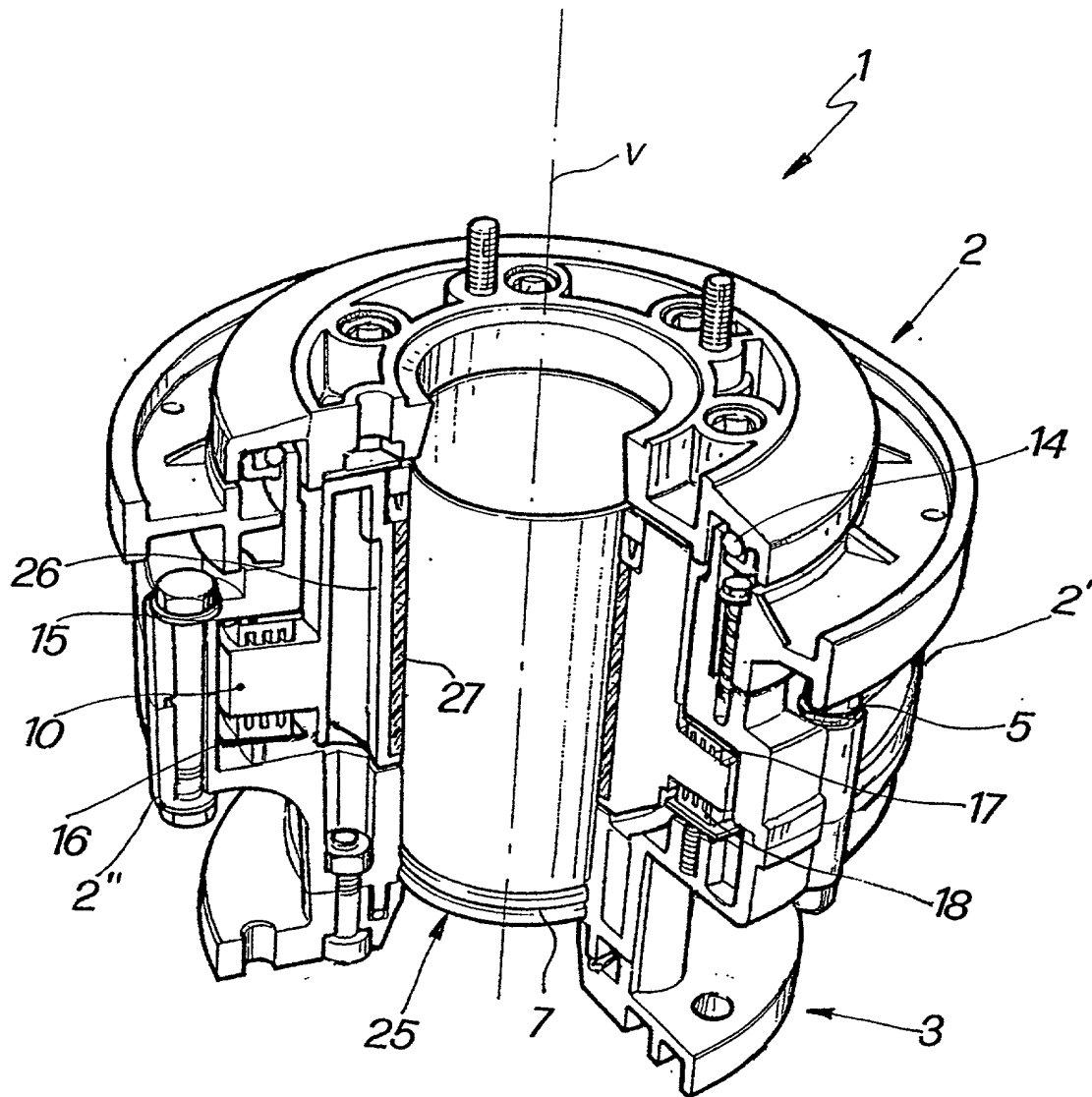
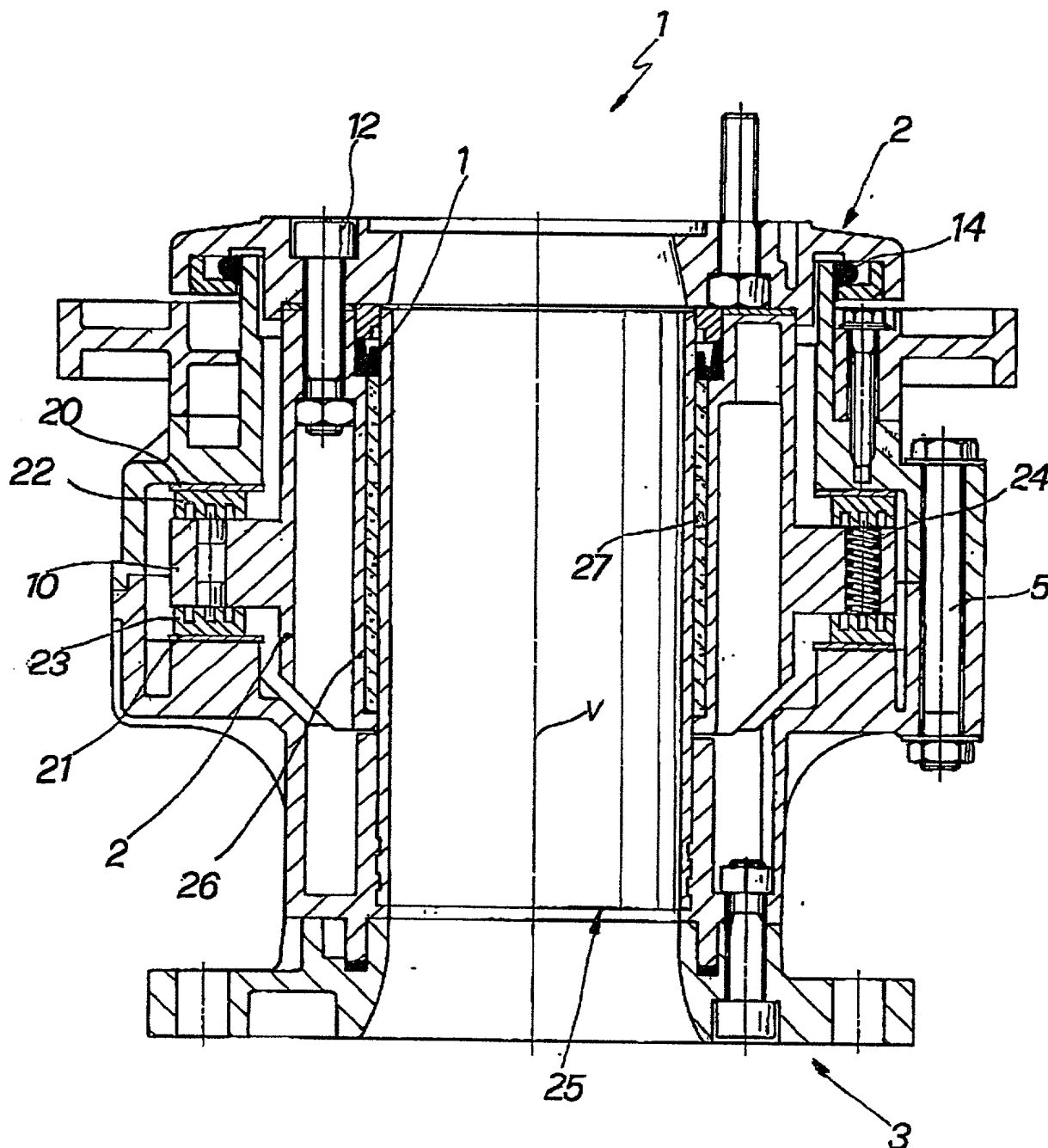


Fig. 4

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5/8



**Fig. 5**

6/8

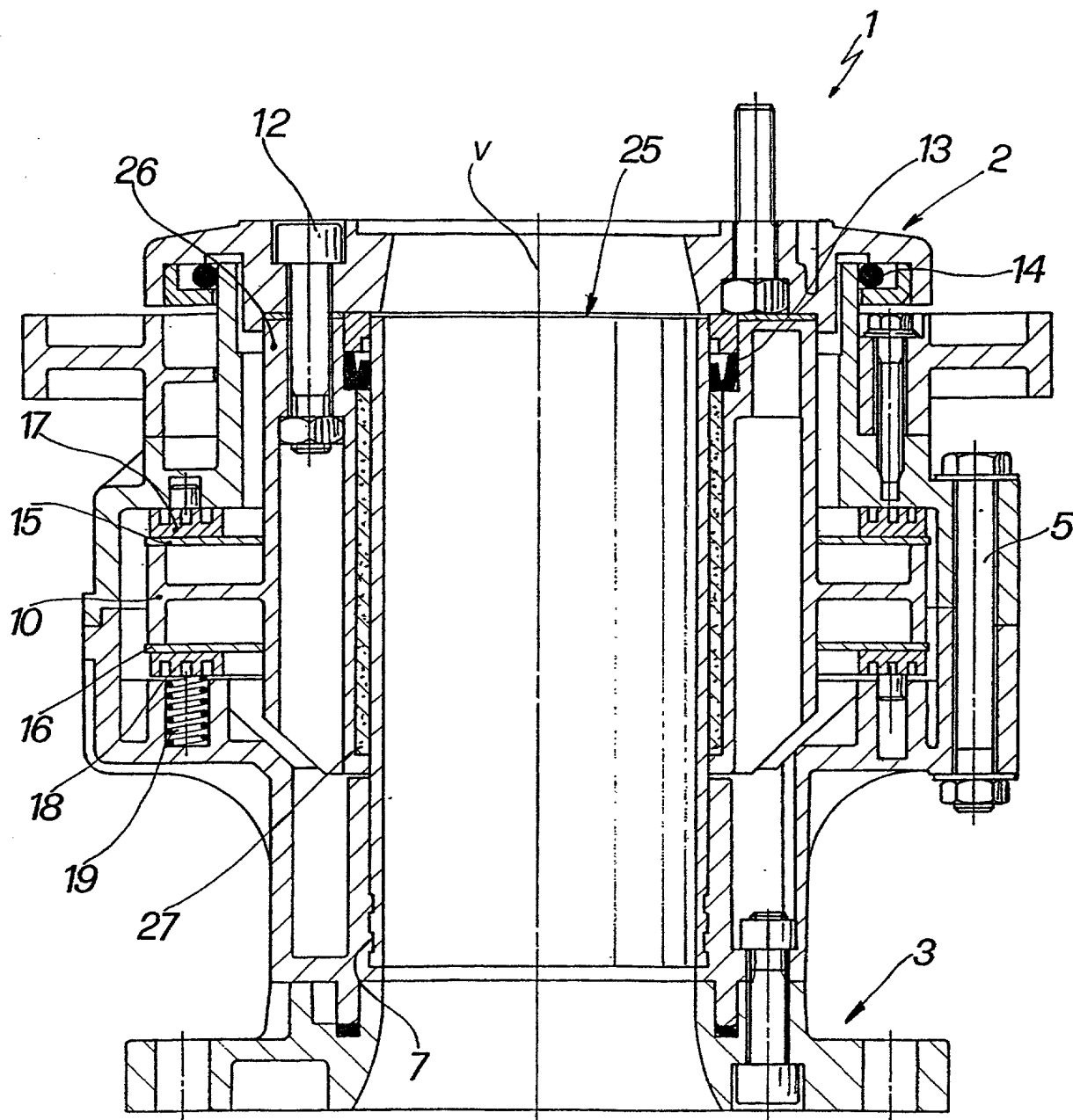


Fig. 6

7/8

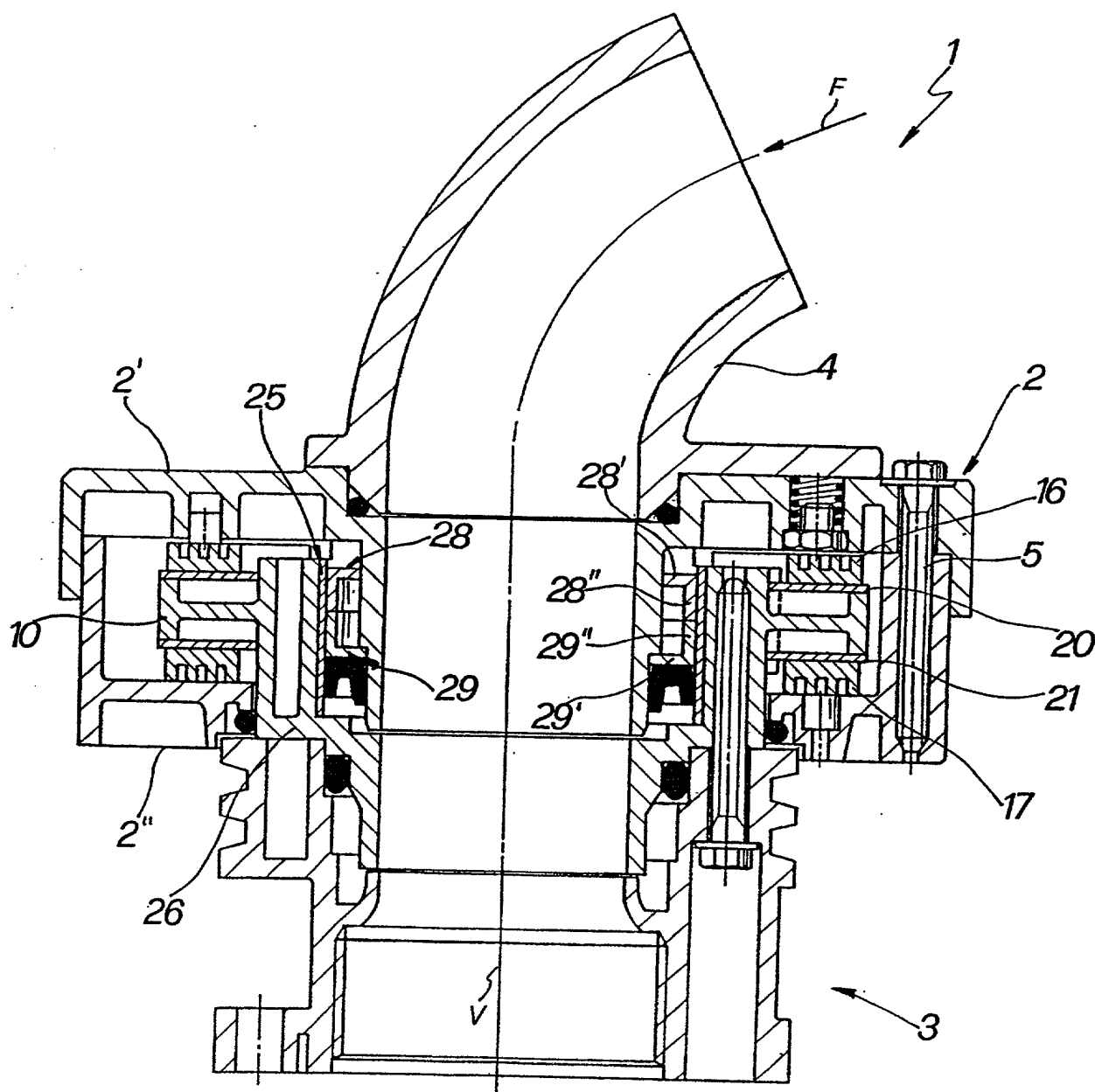


Fig. 7

8/8

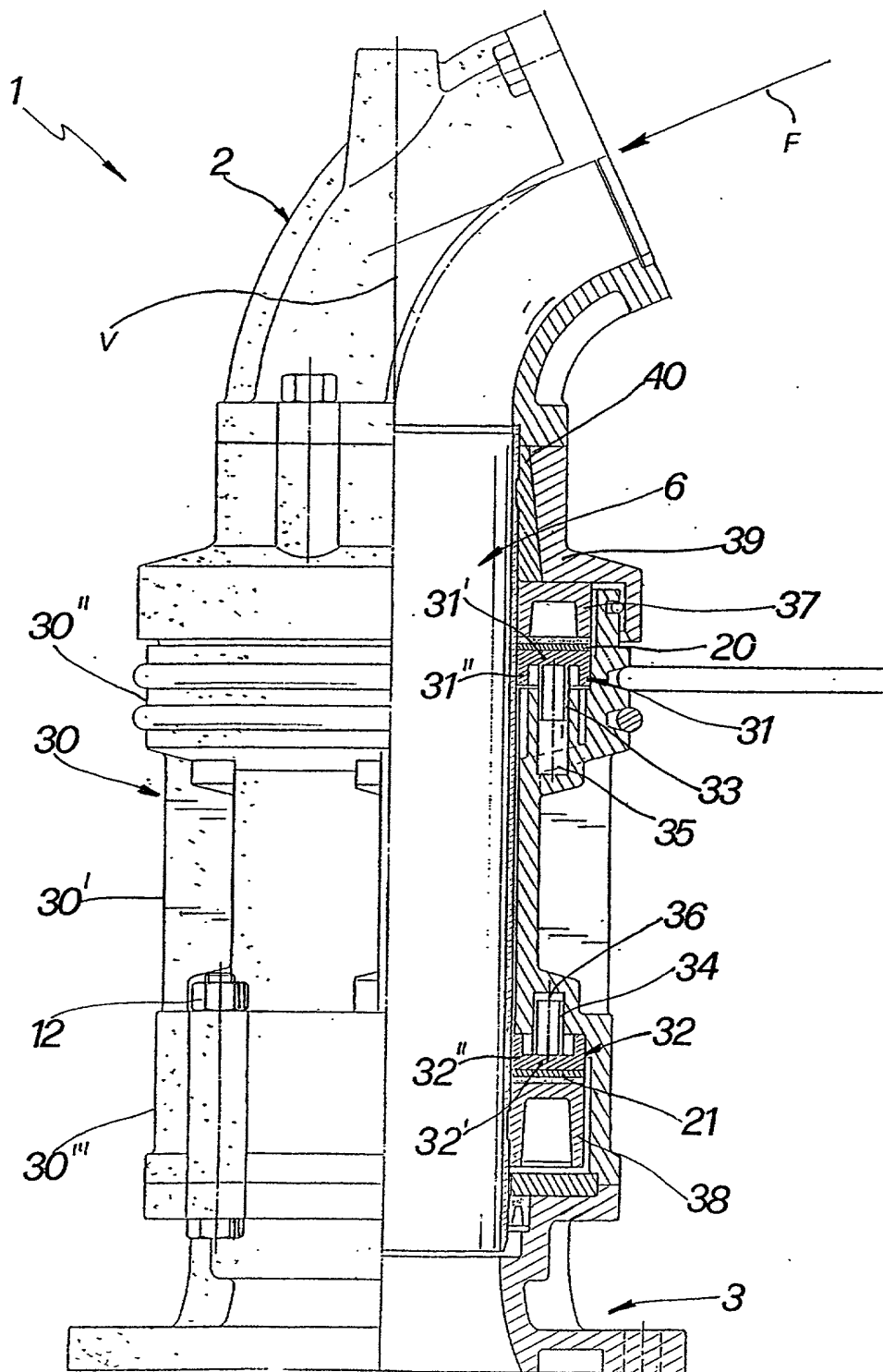


Fig. 8

# Declaration and Power of Attorney for Patent Application

## *Modulo di Dichiarazione Per Domanda di Brevetto*

### Italian Language Declaration

Io, sottoscritto inventore, dichiaro con il presente che:

As a below named inventor, I hereby declare that:

Il mio domicilio, recapito postale e cittadinanza sono quelli indicati in calce accanto al mio nome

My residence, post office address and citizenship are as stated below next to my name.

Che mi reputo in buona fede esse l'inventore originario, primo e unico (qualora un solo nominativo appaia elencato appresso) o il coinventore primo e originario (qualora i nominativi siano più di uno) dell'invenzione da me rivendicata, e per la quale faccio domanda di brevetto. Tale invenzione è chiamata

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

GIUNTO ROTANTE AUTOREGOLANTE  
PARTICOLARMENTE PER DISPOSITIVI DI  
DISTRIBUZIONE DI LIQUIDI

SELF-ADJUSTING ROTATING JOINT, ESPECIALLY  
FOR LIQUID DISTRIBUTION DEVICES

la sua descrizione è qui allegata  
stata presentata il

the specification for which is attached hereto:  
was filed on

Dichiaro inoltre con il presente di aver letto e compreso il contenuto della specificazione sopra indicata, comprese le rivendicazioni, come rettificata da qualsiasi emendamento a cui si sia accennato sopra.

I hereby state that I have reviewed and understood the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

Riconosco il mio dovere di rivelare informazione che è rilevante all'essere brevettabile secondo i termini del Titolo 37, Codice dei Regolamenti Federali, Comma 1.56.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR § 1.56.

Con il presente rivendico i benefici di priorità per l'estero come stabilito dal Titolo 35, Codice degli Stati Uniti, Comma 119(a)-(d) o Comma 365(b), per qualsiasi domanda (o domande) di brevetto straniera o per qualsiasi certificato d'invenzione o per qualsiasi domanda (o domande) internazionale PCT designando almeno un paese altro che gli Stati Uniti, sotto elencato, ed ho anche elencato qui sotto tutte le domande di brevetto e certificati d'invenzione stranieri e domande internazionali PCT aventi una data di presentazione anteriore a quella della domanda (o delle domande) per la quale (o per le quali) si rivendica la precedenza:

I hereby claim foreign priority benefits under Title 35, United States Code, § 119(a)-(d) or § 365(b) of any foreign application(s) for patent or inventor's certificate, or § 365(a) of any PCT International application (s) designating at least one country other than the United States, listed below, and I have also identified below any foreign application(s) for patent or inventor's certificate, or PCT International application(s), having a filing date before that of the application(s) on which priority is claimed.

Prior foreign application(s)  
Domande dall'estero precedenti

Priority claimed  
Precedenza Rivendicata

VI99A0000030  
(Number)  
(Numero)

ITALY  
(Country)  
(Paese)

16/02/1999  
(Day/Month/Year Filed)  
(Giorno/Mese/Anno di Presentazione)

|                                     |                          |
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| Yes                                 | No                       |
| Si                                  | No                       |

PCT/IB00/00162  
(Number)  
(Numero)

PCT  
(Country)  
(Paesi)

16/02/2000  
(Day/Month/Year Filed)  
(Giorno/Mese/Anno di Presentazione)

|                                     |                          |
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| Si                                  | No                       |

## Italian Language Declaration

Con il presente rivendico il beneficio previsto dal Titolo 35, Codice degli Stati Uniti, Comma 120 per qualsiasi domanda (o domande) di brevetto statunitense, o Comma 365(c) per qualsiasi domanda (o domande) internazionale PCT designando gli stati uniti, sotto indicata, ed entro i limiti nei quali il materiale indicato in ciascuna delle rivendicazioni di questa domanda non è stato rivelato nella precedente domanda (o nelle precedenti domande) statunitense o internazionale PCT nel modo previsto dal primo paragrafo del Titolo 35, Codice degli Stati Uniti, Comma 112, riconosco il mio dovere di rivelare informazione che è rilevante all'essere brevettabile, così come viene definito nel Titolo 37, Codice dei Regolamenti Federali, Comma 1.56, che possa essere venuta disponibile nel periodo intercorso tra la data di presentazione della domanda (o delle domande) precedente e la data nazionale o internazionale PCT di presentazione di questa domanda

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s), or §365(c) of any PCT International application(s) designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application(s) in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, §1.56 which became available between the filing date of the prior application(s) and the national or PCT International filing date of this application.

(Application Number) (Filing Date)  
(Numero della Domanda) (Data di Presentazione)

Pending, In attesa di brevetto  
(Status- patented, pending, abandoned)  
(Stato Giuridico – brevettato, in attesa di brevetto, abbandonato)

(Application Number) (Filing Date)  
(Numero della Domanda) (Data di Presentazione)

(Status- patented, pending, abandoned)  
(Stato Giuridico – brevettato, in attesa di brevetto, abbandonato)

Dichiaro inoltre con il presente che tutte le informazioni da me fornite sono in fede mia vere, e che tutte le affermazioni da me fatte sono in fede mia vere; dichiaro inoltre che quando ho fatto queste affermazioni ero al corrente del fatto che false dichiarazioni fatte intenzionalmente sono punibili con multa o incarcerazioni, o ambedue, secondo quanto stabilito dalla sezione 1001 del Titolo 18 del Codice degli Stati Uniti, e che tali informazioni intenzionalmente false possono mettere a repentaglio la validità della domanda o di qualsiasi brevetto rilasciato in base ad essa.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

PROCURA: Io, sottoscritto inventore, nomino con la presente il seguente Procuratore (o Procuratori) e/o Agente (o Agenti) che s'incarica di perseguire questa pratica e di portare a termine tutte le operazioni necessarie all'Ufficio Brevetti e Marchi di Fabbrica pertinenti a questa pratica.

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

Daniel J. O'Byrne (Reg. No. 36,625)

Recapito per la Corrispondenza

Send Correspondence to:

Daniel J. O'Byrne  
Via del Parione, 8  
50123 Florence, Italy EUROPE

Telefonare a:

Direct Telephone Calls to:

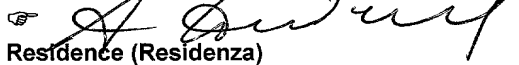
tel.: (001) 39.055 8544665  
fax: (001) 39.055 8544289

## Italian Language Declaration

Full name of sole inventor or first joint inventor (Nome completo dell'inventore unico o del primo coinventore)

DRECHSEL Arno

Inventor's Signature (Firma dell'inventore)



Date (Data)

August 6, 2001

Residence (Residenza)

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Full name of sole inventor or second joint inventor (Nome completo dell'inventore unico o del secondo coinventore)

Inventor's Signature (Firma dell'inventore)



Date (Data)

Residence (Residenza)

Citizenship (Cittadinanza)

Post Office Address (Recapito a Casella Postale)

Full name of sole inventor or first joint inventor (Nome completo dell'inventore unico o del primo coinventore)

Inventor's Signature (Firma dell'inventore)



Date (Data)

Residence (Residenza)

Citizenship (Cittadinanza)

Post Office Address (Recapito a Casella Postale)

Full name of sole inventor or first joint inventor (Nome completo dell'inventore unico o del primo coinventore)

Inventor's Signature (Firma dell'inventore)



Date (Data)

Residence (Residenza)

Citizenship (Cittadinanza)

Post Office Address (Recapito a Casella Postale)

Note to inventor(s): please sign exactly as your name appears, and insert the actual date of signing  
Per inventore: firmare esattamente come il suo nome appare, e compilare la data attuale della firma

**STATEMENT CLAIMING SMALL ENTITY STATUS**  
**(37 CFR 1.9(f) and 1.27(b))--INDEPENDENT INVENTOR**

Applicant, Patentee, or identifier: DRECHSEL Arno  
 Application or Patent No.: \_\_\_\_\_  
 Filed or Issued: \_\_\_\_\_  
 Title: SELF-ADJUSTING ROTATING JOINT, ESPECIALLY FOR LIQUID DISTRIBUTION  
DEVICES HIDES

As a below named inventor, I hereby state that I qualify as an independent inventor as defined in 37 CFR 1.9(c) for purposes of paying reduced fees to the Patent and Trademark Office described in:

- ☒ the specification filed herewith with title as listed above.  
☐ the application identified above.  
☐ the patent identified above.

I have not assigned, granted, conveyed, or licensed, and am under no obligation under contract or law to assign, grant, convey, or license, any rights in the invention to any person who would qualify as an independent inventor under 37 CFR 1.9(c) if that person had made the invention, or to any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e).

Each person, concern, or organization to which I have assigned, granted, conveyed, or licensed or am under an obligation under contract or law to assign, grant, convey, or license any rights in the invention is listed below:

- ☒ No such person, concern, or organization exists.  
☐ Each such person, concern, or organization is listed below.

Separate signatures are required from each named person, concern, or organization having rights to the invention stating their status as small entities. (37 CFR 1.27)

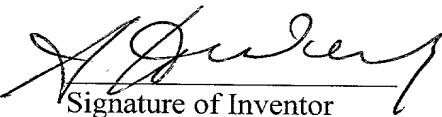
I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b)).

DRECHSEL Arno

Name of Inventor

\_\_\_\_\_  
 Name of Inventor

\_\_\_\_\_  
 Name of Inventor

  
 Signature of Inventor

\_\_\_\_\_  
 Signature of Inventor

\_\_\_\_\_  
 Signature of Inventor

August 6, 2001

Date

\_\_\_\_\_  
 Date

\_\_\_\_\_  
 Date